sation corresponds to blue and yellow, the blue rays exciting it in one direction and the yellow rays in the other. The other source corresponds to red and green, and is excited in like manner. It will at once be seen with what admirable simplicity this will explain colour-blindness, avoiding the violence done to the evidence by the Young-Helmholtz doctrine. Normal-eyed persons possess both sources of sensation; colour-blind persons possess only one. The usual case is when the red-green source is absent, the patient seeing only blue and yellow; but the other defect is possible, giving blindness to blue and yellow, and vision only of red and green; and Dr. Stilling, who strongly espouses the theory, states that rare examples of this have been found. If both sources of sensation are absent, the patient sees only light and shade, and this case also is said to have been practically known.

It is a pity Dr. Jeffries has omitted to mention this theory, which, if it should be substantiated by further inquiry,[1] bids fair to be a most valuable contribution to our knowledge. In the meantime the phenomena of colour-blindness, from the important bearing they have on the nature of colour-perception generally, require much further careful investigation.

WILLIAM POLE

OUR BOOK SHELF

Elementary Lessons on Sound. By Dr. W. H. Stone, Lecturer on Physics at St. Thomas's Hospital. (London: Macmillan and Co., 1879.)

SINCE the publication, some five and twenty years ago, of Helmholtz's great work on musical acoustics, the study of the nature of sound has become popular. The ordinary phenomena of hearing must interest every one; but it is to the thoughtful student of music that the subject presents its chief attractions. We cannot imagine any intelligent musician who will not be desirous to know something of the foundation of the wonderful fabric he has to deal with, and to learn how the principles of science bear on the practice of the art.

It is well, therefore, that Messrs. Macmillan have included among their School Class Books one which gives, in a very small compass, a large amount of information as to the laws and phenomena of sound. The author has not only extracted the essence of what is contained in bulky and expensive treatises, sometimes in foreign languages, but he has also given much additional information from memoirs and transactions of scientific societies out of the reach of the ordinary public.

The application of acoustics to musical instruments is a useful addition, the subject being one which the author has made specially his own. He has also stated some of the simplest facts of the connection between acoustical phenomena and the structure of music; but this is too wide a subject, and involves far too complicated considerations to be fully dealt with in an elementary work of this kind.

We notice a few trifling errors, as, for example, on page 3, the monochord can hardly be said to be "named after" Pythagoras; and Tartini's *terzo suono* was intended by him rather as a guide to correct double-stopping than "tuning." On page 11, line 7, the expression "first partial" is probably meant to be "first overtone." On page 76 a pretty contrivance, by Mr. Francis Galton, is ascribed to Capt. Douglas Galton. These things are, however, of little consequence.

[1] It may be mentioned that one of the main points in the theory has lately received unexpected and powerful support from the brilliant discoveries of Bell and Kühne in regard to the physiology of the retina.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

Local Colour-Variation in Lizards

THE interest which some notes by Messrs. Wallace and Giglioli (published in NATURE) have called forth with regard to the local variation of colour in reptiles causes me to publish these few lines.

Since the year 1874 I have been carefully studying this subject, and therefore wish to remove the generally prevailing opinion that no endeavours have yet been made to explain it. I have not thought it necessary to write this before, thinking that my works touching this subject were known to naturalists, or would have become known through the mention Mr. Carpenter makes of them. Such, however, is not the case. Neither English nor Italian zoologists have taken any notice of the newer German publications concerning the local variation of colour in lizards. They content themselves with merely mentioning many new and truly interesting instances of this variation, but leave unnoticed all attempts made to obtain an explanation of the same.

The first effort to explain this appearance was made by Mr. Eimer in 1872, at the time that the beautiful black and blue lizard was discovered on the Faraglioni rocks, near Capri. Prof. Eimer tries to explain this change of colour in the *Lacerta muralis* (which is green both on the Continent and the Island of Capri) by attributing it to an adaptation to the colour of the Faraglioni rocks. However, as those rocks are not of a bluish-black, but rather a yellowish-red colour, intermixed with a little gray, and as, moreover, the lizards there have no enemies against which they require protection, and therefore no adaptation is necessary, I considered Prof. Eimer's explanation a failure, and at the same time I tried to confirm by fresh facts my hypothesis made in 1874 ("Ueber die Entstehung der Farben bei den Eidechsen," Jena, 1874). This hypothesis, which, it is true, has till now met with little approval, is as follows:—The skin of the lizard has two layers of pigment. The black pigment, which lies lowest, gets the power, under the concentrated influence of the sun, to leave its motionless state, and is made to rise by the contraction which the nerves exercise on the cells containing it, and by forcing itself more or less upwards through the elements of the pale layer of pigment, gives us the impression of different colours. That change of colour which we are able to observe in chameleons in a short space of time, under the condition of a frequent change of light, takes place with lizards only in the course of ages, embodying itself in manifold degrees of development, and provided the animal does not change the locality, remains as a distinguishing characteristic of the form. If, however, the lizard changes its locality, if it is isolated on a rock or islet which has separated itself from the mainland, and is entirely and constantly exposed to the rays of the sun, as must naturally be the case on rocks which, like the Faraglioni or the Island of Ayre, are void of all vegetation, in that case, I say, the black layer of pigment is set in motion, and by constant successive risings to the surface at last gains a definite superposition over the yellow pigment, as has been the case with the black Faraglioni and Lilfordi lizards.

This phylogenetic development of colours can be traced (as I have already mentioned in the year 1874) by the individual development of colour in the lizard, but necessarily only under the constant strong influence of the sun on young individuals. Dr. Braun, in his work on the *Lacerta lilfordi*, informs us that the young lizard of the Island of Ayre has exactly the same colour as its typical form on the larger Balearic islands, and only turns black in the course of its growth.

Though we can only observe the turning black of these lizards in the individual growth of the animal, we can obtain a returning of the full-grown animals to their original paler colours by artificial means, that is, by preventing the rays of the sun from falling on them perpendicularly. By these means I completely discoloured numbers of the Faraglioni lizards and the brown ones from the island of Ponza. The former turned bluish-green, the latter brownish-green.

Before I pass on to an enumeration of the above-named trans-

formed lizards, I shall just mention a third endeavour which has been made to explain the black colour of the lizards inhabiting small islets.

In his interesting book, "Beiträge zur Descendenz-Theorie," Leipzig, 1876, Seidlitz has tried to introduce the belief that the black colour serves as an armour or protection to the animal against the burning rays of the sun. Thereupon I sought to prove that reptiles inhabiting the desert would need such a protection more than the others, yet they are not black.

As some might perhaps draw, from what I have said, the conclusion that, according to my hypothesis the reptiles of the desert should be also black, I must remark that the scorching rays of the sun in the desert effect so strong an elevation in the temperature of the soil, that it brings forth a relaxation in the animal, and slackens the energetic movement of the pigment, consequently the extreme heat counteracts the effect which the light produces, whilst on the islets of the Mediterranean the heat is alleviated by the sea breezes and by a certain degree of dampness. As we already know, all our European species of lizards carefully avoid the desert.

The dark-coloured lizards at present known, which inhabit small islands, are the following ones :—

1. *Lacerta muralis, var. archipelagica,* De Bedriaga: "Die Faraglioni-Eidechse." (Heidelberg, 1876; pp. 19.) *L. muralis, var.* B. Erhard: "Fauna der Cykladen," (Leipzig, 1858; pp. 80.) *L. muralis, var. C.*, Schreiber: "Herpetologia europæa." (Braunschweig, 1875; pp. 408.) *L. muralis, var. archipelagica,* v. Bedriaga: "Herpetologische Studien," im *Archiv für Naturgeschichte,* 1878.

Back and extremities black, covered with rows of green spots. Belly and tail black. Inhabits the Cyclades.

2. *Lac. muralis var. melisellensis,* Braun: *Lacerta lilfordi* and *L. muralis;* "Arbeiten aus dem zoolog. zootom. Institut in Würzburg, 1877."

Back brown, ornamented with six light longitudinal stripes. Belly dark blue, chin rather lighter. Length 130 mm. Inhabits the islet Melisello near the island of Lissa, in the Adriatic Sea.

3. *L. muralis, var. filfaensis,* De Bedriaga: "Die Faraglioni Eidechse." (Heidelberg, 1876.) Braun, *l.c.* v. Bedriaga: "Herpetologische Studien," in *Archiv f. Naturg.,* 1879. Günther: "Description of a new European Species of Zootoca," *Annals and Magazine of Natural History,* 1874.

Back black covered with small green specks, the under parts are deep blue. Length 212 mm. Inhabits Filfla, near Malta.

4. *L. muralis, var. faraglioniensis,* De Bedriaga: "Ueber die Entstehung der Farben bei den Eidechsen." (Jena, 1874.) *L. muralis var. cærulæa,* Eimer: "Zoologische Studien auf Capri." (Leipzig, 1874.) Braun, *l.c.*

Back black, the sides blue spotted with black; the belly a brilliant blue. Length 220 mm. Inhabits the Faraglioni Rock, near Capri.

5. *L. muralis, var. Latastei,* De Bedriaga: "Herpetologische Studien," in *Archiv f. Naturg.,* 1879, pp. 264.

Back and sides brown, or dark brown covered with black spots, sometimes with bluish green spots on the sides. Above the root of the forelegs a bluish spot. Length 205 mm. Inhabits Ponza near Gaeta.

6. *L. muralis, var. Lilfordi,* Günther: "Description of a New European Species of Zootoca," *l.c.* Braun, *l.c.*

Upper parts of a deep glossy black, lower parts of a beautiful sapphire blue. Length 175 mm. Inhabits the Island of Ayre, near Minorca.

7. *L. muralis, var. Gigliolii,* De Bedriaga: "Herpetologische Studien," 1879, *l.c.*

Forepart of the back covered with alternately green and blue stripes. The hind part of the back is dark blue. The sides are light brown with green and blue spots. The belly brick-red with (sometimes without) small blue stripes. Colouring varies. Length 175 mm. Inhabits Isla del Dragoneras near Majorca.

8. *L. muralis, var. Rasquineti,* De Bedriaga: "Herpetologische Studien," 1878, *l.c.*

Back olive brown with a black pattern. Blue eye-spots ornament the sides. Belly brick-red. The first longitudinal rows of the ventral scales are blue. Length 185 mm. Inhabits the islet La Deva near Arnao (Spain). J. VON BEDRIAGA

Heidelberg, August 28

Insect Swarms

THIS year being remarkable for "insect swarms," it is important that all possible information about them should be gained, so as to satisfactorily account for these phenomena. As to *Vanessa cardui,* which has been abundant throughout the spring and summer, it is possible that some of those specimens which occurred in the spring were the result of a migration from the Continent, but there is no doubt that the specimens which are now seen are nearly, *if not all,* bred in this country from ova deposited by the spring specimens, quite sufficient time having elapsed for the metamorphosis. With regard to *Plusia gamma,* I am of opinion that all the specimens seen, and they have been in profusion here from about August 10 till the present time, have been bred *in this country.* My reason for so believing is that the larvæ were most abundant in the spring, doing damage in gardens to a great extent. Some of these larvæ I fed up, the perfect insects emerging at the time *P. gamma* first appeared in abundance. My experience of the swarms of *P. gamma* is that they moved in no particular direction, merely passing in numbers from flower to flower, flowers being scarce this year, any apparent migration being simply a search for more flowers. Instead of putting the cause of these swarms down to "migration," endeavours should be made to discover the causes of the extraordinary periodical fecundity. It is quite probable, too, that next year, *P. gamma* and *V. cardui* will be scarce, as is frequently the case with *Colias edusa* and *hyale* after a year of abundance. J. H. A. JENNER

Lewes, September 13

Earthquakes

I HAVE observed, in several recent numbers of NATURE, various notices of earthquakes, so frequent as to suggest the idea to me (perhaps incorrect) that for several months past they have been more numerous than usual. Since my arrival in West Java I have experienced several severe shocks. On March 28, between 7 and 8 P.M., I was startled by a peculiar shivering as I sat in my chair. At first I imagined I was seized with a terrible feverless ague, but I was soon undeceived by the increased bumping and the clashing of my bottles, &c., and the vehement beseeching of *Tuhan* Allah, and the loud exclamations of the natives of, "We are here!" "We are all here!" I learned in a few days that several villages lying at the base of the peccant volcano, Gedè, had suffered; in particular the town of Ijandjoer, in which numerous houses were destroyed, many bridges broken down, the telegraph apparatus entirely thrown out of gear, and six or seven persons killed. The ground also opened and emitted volumes of smoke, while the Gedè itself burst out with extra vigour, throwing out, in addition to the usual white steamy vapour, large quantities of smoke and ashes, fortunately to no great distance. Throughout the 28th and 29th there was a succession of shocks. On June 3 I experienced a second earthquake, undulatory but not very severe; and again on the 5th, undulatory, of considerable duration, and severe enough to thoroughly shake the whole house and throw down unfixed objects. These have done no damage to life, as far as I have heard, and, beyond some houses being cracked in Batavia, little to property. Since the beginning of March there have been numerous shocks, but none so violent as those of March 28 and June 5. Immediately preceding the shock of June 5 there was a sudden and heavy fall of rain, the drops being very large. The direction of the wave was from east to west. HENRY O. FORBES

Kosala, Bantam, July

Leaping Power of Mantis[1]

I CAN state from my own observations of several different species, both in Ceylon, South Africa, and Fiji, that the power is possessed by many, chiefly in the larval stage, and that the distances they can spring from branch to branch are very considerable for the size of the insect. E. L. LAYARD

British Consulate, Noumea

OUR ASTRONOMICAL COLUMN

THE OUTER SATELLITE OF MARS.—The following positions of *Deimos,* the exterior satellite of Mars, are deduced from the data published in Prof. Asaph Hall's memoir, in which he determines the elements of the satellite-orbits :—

[1] NATURE, vol. xx. p. 595.